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Blended Learning Approach impact on students with ADHD Social and Critical Thinking Abilities

Indira Das Mohapatra[1]*, Prof. (Dr). Satya Prakash Yadav[2]

[1] Research Scholar, YBN University, Ranchi, Jharkhand, India

Email: indiradasdd@gmail.com

[2] Professor, Department of Education, YBN University, Ranchi, Jharkhand, India

Abstract - This study investigates the impact of a blended learning approach on the social and critical thinking abilities of students with Attention Deficit Hyperactivity Disorder (ADHD). Blended learning, which combines traditional face-to-face instruction with online components, is posited to create a flexible and engaging learning environment that can cater to the unique needs of students with ADHD. The research employs a mixed-methods design, utilizing both quantitative assessments of critical thinking skills and qualitative interviews to gauge social interactions among students. Findings indicate that students with ADHD demonstrate significant improvements in both critical thinking and social skills when engaged in blended learning environments. The study concludes that such an approach can effectively support the cognitive and social development of students with ADHD, suggesting implications for educational practice and future research.

Keywords: Blended Learning, ADHD, Critical Thinking, Social Skills, Educational Approaches, Mixed-Methods Research

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INTRODUCTION

Education is one of the most fundamental human requirements. It's a systematic process that equips individuals with the knowledge, skills, attitudes, beliefs, and habits they need to develop in a harmonious manner. Put another way, it makes people's search for wholeness easier. According to Parankimalil (2012), completeness in this sense refers to the harmonious development of each individual human potentiality, which finally promotes both national and international development. As a result, the 86th constitutional amendment was ratified in 2002 and declared that everyone should have access to education as it is a basic human right. But the "education for all" objectives of the 86th constitutional amendment can only be realised when all children's needs, particularly those of the most disadvantaged and marginalised, are satisfied (EFA, UNESCO).

According to a World Health Organisation research, 1.8–6.47% of preschool-aged children worldwide suffer from ADHD. The incidence rate of ADHD rises dramatically when we include children and teens; it was estimated to be between 5.29 and 7.16%. The American Psychiatric Association (2000) states that 3-7% of children in school age have ADHD, which may be the most prevalent behavioural problem among pupils. Comprehensive studies on ADHD in children in India are few. The estimated frequency of this condition in the 5–12 age group was 15.5%, according to Mukhopadhyay et al. (2003). According to a number of similar research that are now available, 2–16% of individuals with ADHD (Skounti, et al., 2007).

ADHD

ADHD is a developmental neurobehavioral disorder that is persistent, inherited, and may manifest in infancy, childhood, or maturity. According to study, between one-third and half of children with ADHD have symptoms that persist into adulthood, according to the American Academy of Paediatrics (2007). ADHD is one of the 18 disorders included by the DSM IV-TR's common Axis-I. ADHD symptoms are referred to as hyperkinetic syndrome disorder in ICD-10. Both the DSM IV-(TR) and the ICD-10 believe that the typical symptoms of ADHD, which include difficulties focussing and paying attention, issues controlling behaviour, and hyperactivity or overactivity, start in early infancy.

In environments other than classrooms, children with ADHD act in a manner that is significantly different from ordinary childhood behaviour. They are social and enthusiastic. ADHD symptoms include poor self-esteem, irrational anger, peer rejection, limited tolerance for frustration, and violent outbursts. As a consequence, children's life may suffer at home, at school, in relationships, at work,

and in the community. There are reports of ADHD from all across the world; however, statistical variations may arise from various cultural interpretations of behaviour. The Netherlands has the lowest prevalence of ADHD, at 2%, while India has the highest rate, at 30%. Up to 10% of Americans suffer from the disorder. There is an ADHD prevalence in every country, ethnic group, and socioeconomic class. The prevalence figures below are the outcome of research carried out across many nations:
Brazil is at 5-6%, Canada is at 5-14%, China is at 6-9%, Germany is at 4%, India is at 5-29%, Japan is at 7-8%, New Zealand is at 2-7%, and the UK is at 3-5%. A 2005 survey indicated that 5.1% of children and 8.9% of teens in the US had ADHD. Research indicates that 2% to 4% of adults may also be affected, and 5% of children between the ages of 9 and 17 are affected at any one time.

Approximately one in 25–25% of children and young people have ADHD. Conservative estimates place the prevalence of ADHD in school-age individuals at 3% and 5%. Furthermore There are around three times as many affected males as girls. There were five males for every female among youngsters with ADHD. Several studies carried both in the West and India have shown that men are more prone than women to have the illness. Stephen et al. (2003) concluded that ADHD is a behavioural problem affecting one to twenty children in the United States and other countries after examining all 50 MEDLIN research on the subject. Additionally, they agreed that ADHD is not exclusive to the United States and that its incidence in many other nations is equivalent to that of the US. The present statistics in India, which are based on patients from clinics or hospitals with skewed referrals or screening questionnaires, vary greatly from 1 to 20%. India is home to the largest number of children in the world, 190 million, between the ages of 6 and 14, according to statistics from the Economic Survey of India (2004). According to Siddique et al. (2010), children in Delhi who were between the ages of 12 and 14 had the highest incidence of ADHD (14.2%).

Blended learning

Like many other breakthroughs in educational practices, blended learning has multiple meanings and uses. Blended learning refers to the integration of various learning resources with both in-person and online instruction. The innovative and technological innovations of online learning are combined with the interaction and engagement of traditional classroom teaching to create blended learning, a flexible approach to education. Thorn (2003) claims that blended learning solves the issue of tailoring learning and development to each person's needs by fusing the best elements of traditional education with state-of-the-art technological breakthroughs. Blended learning is defined as combining online content delivery with the best aspects of live instruction and classroom interaction to personalise learning, allow for thoughtful reflection, and differentiate instruction from student to student across a diverse group of learners. The North American Council for Online Learning [NACOL], an international association for K–12 online learning, has supplied this description. Carter (quoted in Battye & Carter, 2009) defines blended learning as a deliberate and purposeful approach to teaching and learning that skilfully blends different pedagogies and modalities such that virtual and in-person learning complement one other.

Beyond the combination of online and in-person training, the exact definition of blended learning may not important in the end. Kim (2007) separated education into three primary groups: formal vs informal, scheduled versus self-paced, and in-person versus online classes. There are several possible combinations that may be created with these three dimensions. He defines blended learning as mixing two or more of the several accessible learning modalities. To this concept, he has added an important qualification. Online learning is required for one of the learning modes, while in-person, classroom-based learning is required for the other. This is to guarantee that traditional and online teaching approaches are still used in blended learning. While blended learning reflects a more deliberate and conscious approach to designing optimal instruction or learning environments following the strategy of blending components, the blended nature of traditional instructional contexts is primarily the result of habit (tradition), convenience, or happenstance. It's common misconception that blended learning consists only of integrating online elements to traditional classroom training. But the most common result of this is the "course-and-a-half," a dysfunctional phenomenon (Educause, 2010). Schools may be particularly susceptible to this trap if the extra online components are solely focused on the newest technology, since this might provide the impression of true innovation that is deceptive.

The neurodevelopmental illness known as Attention Deficit Hyperactivity illness (ADHD) is characterised by a child's inability to focus on a specific task and their impetuous and hyperactive behaviour. In order to understand the nature of ADHD, let's take a look at its history and onset.

METHODOLOGY:

This research was purely experimental. The study used a controlled group-experimental design with a pretest-posttest period. The independent variable instructional strategy was tested using an independent samples t-test to determine its influence on the dependent variables critical thinking and social skills, as well as their dimensions. Blended learning approach (A1) and traditional technique (A2) were the two groups that the instructional strategy variable (A) was analysed within. Two dependent variables, Critical Thinking and Social Skills, and their dimensions were used to evaluate the impact of these two instructional strategies in this research. B1 was assigned to the

critical thinking variable while B2 was assigned to the social skills variable. Figure 3.1 shows the research design that was employed in the study.

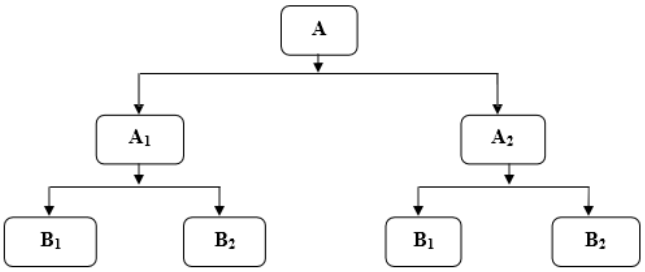

Figure Research design for independent variable of Instructional strategy and dependent variables of Critical Thinking and Social Skills

In order to get the results, the experiment's design and technique were followed to the letter.

1. results on a test measuring critical thinking and its two subtests, process and product, both before and after the intervention.

2. The results of the pre- and post-tests on the social skills component, which includes the following abilities: concern for others, communication, self-care, self-control, and the ability to make decisions and solve problems.

3. For this analysis, we used mean gain scores on two dimensions of critical thinking: process and product. We also used mean gain scores on two dimensions of social skills: skill in caring for others, ability to communicate effectively, ability to care for oneself, and ability to make decisions and solve problems.

In order to put the theories to the test, the following statistical methods were employed:

Descriptive statistics, such as measures of central tendencies, median, standard deviation, skewness, and kurtosis, were employed to examine the distribution of pre- and post-test scores on the critical thinking and social skills variables, along with their respective dimensions, of students with attention deficit hyperactivity disorder (ADHD). These variables include the ability to care for oneself and others, as well as the ability to communicate effectively, make sound decisions, and solve problems.

In order to determine whether the dependent variables within the groups had a homogeneous variance, the current research used the following inferential statistical techniques: The test for equality of variances was applied.

The Experimental group that was taught using a blended learning approach and the Control group that was taught using a traditional method were compared using an independent samples t-test to see whether there were any changes in the mean gain scores.

A coefficient of determination (Cohen's d) was computed to investigate the impact of the instructional strategy independent variable on the dependent variables of critical thinking and social skills. The dependent variables of critical thinking and social skills include process of thinking, product of thinking, skill of concern for others, communication skills, self-care/self-control, and decision making/problem solving abilities.

RESULT AND DISCUSSION

This section aims to shed light on the distribution of scores for students with ADHD on the following variables: critical thinking (including its dimensions: process and product thinking) and social skills (including its dimensions: skill in caring for others, ability to form and maintain relationships, ability to communicate effectively, ability to take care of oneself, ability to control one's impulses, and ability to make sound decisions and solve problems). To gain insight into the distribution of scores on the Critical Thinking and Social Skills variables, along with their respective dimensions (Process of Thinking, Product of Thinking, Skill of Concern for Others, Relationship/Friendship Skills, Communication Skills, Self-Care/ Self-Control Skills, and Decision Making/Problem Solving Skills), we compute descriptive statistics like Mean, Median, Standard Deviation, Skewness, and Kurtosis for the Total Sample, the Experimental group (those taught using the Blended learning strategy), and the Control group (those taught using the Traditional method) variables. The following tables display these values:

Table 1: The pre-test, post-test, gain scores, mean, median, standard deviation, skewness, and kurtosis of the entire sample of ADHD students as well as the dimensions of social skills, such as the skills of concern for others, relationship/friendship skills, communication skills, self-care/self control skills, and decision making/problem solving skills, as well as the categories of process and product of thinking, are all included.

TOTAL SAMPLE (N=300)

Variables		Mean	Median	SD	Skewness	Kurtosis
Critical thinking	Pre-test	25.75	26	5.96	0.12	-0.12
	Post-test	35.56	35.5	7.93	0.24	-0.50
	Gain Scores	9.81	10	4.99	0.17	-0.81
Process of Thinking	Pre-test	24.09	24	5.64	0.07	-0.11
	Post-test	32.30	32	7.62	0.25	-0.23
	Gain Scores	8.21	8	4.70	0.26	-0.78
Product of Thinking	Pre-test	1.66	2	1.03	0.30	-0.25
	Post-test	3.26	3	1.29	0.00	-0.58
	Gain Scores	1.6	2	0.96	0.10	-0.24
Social Skills	Pre-test	308.26	331.5	80.41	-0.77	-0.57
	Post-test	366.11	384.5	61.79	-0.91	-0.03
	Gain Scores	57.85	58	32.70	0.24	0.22
Skill of Concern for	Pre-test	81.63	86	20.88	-0.84	-0.22

Others	Post-test	91.19	96	21.58	-0.77	-0.36
	Gain Scores	9.56	9	7.68	0.29	-0.92
Relationship/ Friendship Skills	Pre-test	62.11	67	17.72	-0.62	-0.83
	Post-test	74.56	79	12.97	-0.82	-0.23
	Gain Scores	12.45	9	19.87	0.40	0.68
Communication skills	Pre-test	57.19	59	16.96	-0.41	-0.46
	Post-test	67.95	72	14.49	-0.82	-0.27
	Gain Scores	10.98	11	5.00	-0.07	0.07
Self-Care/Self Control Skills	Pre-test	59.38	62	18.35	-0.51	-0.67
	Post-test	69.83	76	17.21	-0.72	-0.60
	Gain Scores	10.45	10	5.70	0.48	-0.41
Decision Making/ Problem Solving Skills	Pre-test	47.96	49	14.95	-0.32	-0.69
	Post-test	62.38	65.5	11.12	-0.88	0.22
	Gain Scores	14.41	14	9.00	0.50	-0.32

Table 1 shows that the mean and median of the entire sample of ADHD students are roughly equal for the following variables: social skills and its dimensions (communication skills, relationship/friendship skills, self-care/self control skills, and decision making/problem solving skills), critical thinking and its dimensions (process and product of thinking, and skill of concern for others). The distribution of pre-test, post-test, and gain scores for these variables is almost normal for the whole sample, as shown by the little variation in the values.

For the Critical Thinking variable and its dimensions (Process of Thinking and Product of Thinking) and the Social Skills variable and its dimensions (Skill of Concern for Others, Relationship/Friendship Skills, Communication Skills, Self-Care/Self Control Skills, and Decision Making/Problem Solving Skills), the skewness values on the pre-test scores are, respectively, 0.12, 0.07, 0.30, - 0.77, -0.84, -0.62, -0.51, -0.51 and -0.32. In contrast, the distribution of scores on the social skills variable and its dimensions—skill of concern for others, relationship/friendship skills, communication skills, self-care/self control skills, and decision making/problem solving skills—is slightly negatively skewed. This is because the pre-test scores on the critical thinking variable and its dimensions—process of thinking and product of thinking—are slightly positively skewed.

Table 2 illustrates that the skewness value remained within the permissible range of the distribution's normalcy, or ± 1. Hence, the distribution of skewness on the variables of critical thinking and its dimensions—that is, the process and product of thinking—and social skills, along with its dimensions—that is, the ability to care for others, build relationships and friendships, communicate, engage in self-care and self-control, and make decisions and solve problems—may be regarded as normal.

Kurtosis values on pre-test scores are marginally less than the table value of 0.263 for a normal distribution. These values apply to the Critical Thinking variable and its dimensions, Process of Thinking and Product of Thinking, as well as the Social Skills variable and its dimensions, Skill of Concern for Others, Relationship/Friendship Skills, Communication Skills, Self-Care/Self Control Skills, and Decision Making/Problem Solving Skills. As a result, the pre-test scores' suggested distribution for these factors is rather leptokurtic.

The kurtosis values on post-test scores for the Critical Thinking variable and its dimensions—Process of Thinking and Product of Thinking—and the Social Skills variable and its dimensions—Skill of Concern for Others, Relationship/Friendship Skills, Communication Skills, Self-Care/Self Control Skills, and Decision Making/Problem Solving Skills—are marginally less than the table value of 0.263 for a normal distribution. As a result, the post-test scores for these variables have a distribution that is rather leptokurtic.

The variables of Social Skills and its dimensions—Skill of Concern for Others, Communication Skills, Self-Care/Self Control Skills, and Decision Making/Problem Solving Skills—as well as the variable of Critical Thinking and its dimensions, Process of Thinking and Product of Thinking, have kurtosis values on gain scores that are marginally less than the table value of 0.263 for a normal distribution. As a result, the distribution of these variables is somewhat leptokurtic, whereas the kurtosis value for the Social Skills dimension—that is, Relationship/Friendship Skills—on gain scores is somewhat higher than the 0.263 value in the table. As a result, it is thought that the distribution for this variable on gain scores is rather platykurtic.

As Table 1 above illustrates, the kurtosis values were consistently around 0.263. Consequently, it is possible to regard as normal the distribution of Kurtosis on the following variables: the variable of social skills and its dimensions, which include the skills of concern for others, relationship/friendship skills, communication skills, self-care/self control skills, and decision making/problem solving skills; and the variable of critical thinking and its dimensions, which include process of thinking and product of thinking.

The pre-test, post-test, and gain scores on the Critical Thinking variable and its dimensions—Process of Thinking and Product of Thinking—as well as the Social Skills variable and its dimensions—Skill of Concern for Others, Relationship/Friendship Skills, Communication Skills, Self-Care/Self Control Skills, and Decision Making/Problem Solving Skills—may therefore be interpreted from Table 5.1.1, which shows that the entire sample (N=300) is normally distributed.

The students with ADHD in the blended learning strategy group (the experimental group) and the traditional method group (the control group) are matched in this section based on homogeneity determined by pre-test scores on the critical thinking variable and its dimensions (process and product of thinking) and the social skills variable and its dimensions (skill of concern for others, relationship/friendship skills, communication skills,

self-care/self control skills, and decision making/problem solving skills) prior to the experiment. It is a prerequisite for carrying out two experimental group studies. In the current study, the 300 ADHD students that make up the Control and Experimental groups are matched based on their pre-test scores on two different variables: social skills and its dimensions (communication skills, relationship/friendship skills, self-care/self control skills, and decision making/problem solving skills) and critical thinking and its dimensions (process and product of thinking). T-values of the pre-test mean scores were calculated to match the groups and determine whether the ADHD students in the group taught using the blended learning strategy (called the experimental group) and the group taught using the traditional method (called the control group) differed significantly on any relevant variables. The values are summarised in the tables that follow:

Table 2: t-values between the pre-test mean scores on critical thinking along with its dimensions—process of thinking and product of thinking—of students with ADHD in the groups taught using the blended learning strategy (experimental group) and the traditional method (control group).

Variables	Groups	N	Mean	SD	t-value	Sig. (2-tailed)
Critical Thinking	Experimental Group	40	25.73	6.45	0.04	.97
	Control Group	40	25.78	5.51		
Process of Thinking	Experimental Group	40	24.03	6.07	0.10	.92
	Control Group	40	24.15	5.25		
Product of thinking	Experimental Group	40	1.7	1.04	0.32	.75
	Control Group	40	1.63	1.03		

t= 1.990 to be significant at 0.05 level for 78 degrees of freedom t= 2.640 to be significant at 0.01 level for 78 degrees of freedom *Significant at 0.05 level

Table 2 shows that the experimental group taught using a blended learning strategy and the control group taught using a traditional method had different pre-test mean scores on the critical thinking variable. The difference was statistically not significant, with a t-value of 0.04. This suggests that prior to the trial, there was no discernible difference in the Critical Thinking skills of the groups taught using the Traditional Method and the Blended Learning Strategy.

The experimental group taught using a blended learning strategy and the control group taught using a traditional method had different pre-test mean scores on the Critical Thinking dimension, specifically Process of Thinking. The difference in these scores was 0.10, which is statistically not significant. This suggests that, prior to conducting the experiment, there were no significant differences between the groups taught using the blended learning strategy and the traditional method in terms of the thinking process or the critical thinking component. The statistically insignificant difference in pre-test mean scores of students with ADHD on the Critical Thinking dimension, specifically Product of Thinking, between the experimental group taught using a Blended Learning Strategy and the control group taught using a Traditional Method, can be found in the t-value of 0.32. This suggests that before the experiment was conducted, there was no discernible difference between the groups taught using the blended learning strategy and the traditional method in terms of the Product of Thinking and Critical Thinking dimensions.

Blended Learning Strategy Effect on Critical Thinking of students with ADHD

H_{01} There is no significant difference in mean gain scores of Critical Thinking of groups of students with Attention Deficit Hyperactivity Disorder taught with blended learning strategy and traditional method.

H_1 There is significant difference in mean gain scores of Critical Thinking of groups of students with Attention Deficit Hyperactivity Disorder taught with blended learning strategy and traditional method.

Table 3: The t-value compares the mean Critical Thinking gain scores of ADHD students in the Experimental group who were taught using a blended learning strategy with the Control group who were taught using a traditional method.

Group	N=300	Mean Gain Scores	SD	Df	Mean Difference	t-value	Sig. (2-tailed)	d (Cohen's *d*)
Experimental Group	150	13.95	2.94	78	8.27	13.34***	*p*<.001	2.98
Control Group	150	5.68	2.61					

t= 1.990 to be significant at .05 level for 78 degrees of freedom t= 2.640 to be significant at .01 level for 78 degrees of freedom t= 3.420 to be significant at .001 level for 78 degrees of freedom

*Significant at .05 level

** Significant at .01 level

*** Significant at 0.001 level

Table 3 makes it clear that there is a statistically significant difference in the mean Critical Thinking gain scores of ADHD students taught using the Blended Learning Strategy in the Experimental group and the Traditional Method in the Control group. The difference is t (78) =13.34, p<.001, two-tailed. At the.001 level of significance, the computed "t" value of 13.34 is higher than the crucial "t" value of 3.42 for df=78. As a result, the alternative hypothesis, H1, which states that there is a significant difference in the mean gain scores of Critical Thinking of groups of students with Attention Deficit Hyperactivity Disorder taught with blended learning strategy and traditional method, is accepted, and the null hypothesis, H01, which states that there is no significant difference in mean gain scores of Critical Thinking of groups of students

with This disorder stands rejected. The equal variance t-test (t(78) =13.34, p<.001, one-tailed) is statistically significant as the alternative hypothesis is accepted.

It is determined that the effect size for this study (d=2.98) is greater than the big effect convention (d=.80) established by Cohen (1988). It suggests that when compared to traditional methods, blended learning strategies have a significant impact on improving students with ADHD's critical thinking.

Figure 4.2 shows a graphic depiction of the mean gain scores for the critical thinking variable for the Experimental group, which was taught using a blended learning strategy, and the Control group, which was taught using a traditional method.

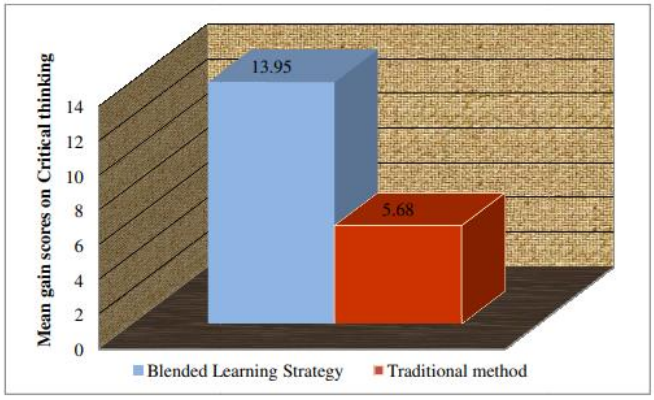

Figure 2: A graph comparing the average development scores of ADHD children taught utilising a blended learning approach to a conventional form of instruction, based on the critical thinking variable.

CONCLUSION:

In this sense, learners are given room to use higher order critical thinking skills via the Blended Learning Strategy that the researcher implemented for the experimental group. These might perhaps be the causes of the ADHD students in the experimental group who were taught using a blended learning strategy scoring better on the critical thinking test than the students in the control group who were taught using a traditional method. These might be the real-world explanations for the variations in the Critical Thinking of the students in the blended learning group.

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Corresponding Author

Indira Das Mohapatra*

Research Scholar, YBN University, Ranchi, Jharkhand, India

Email: indiradasdd@gmail.com